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Notwithstanding the great importance of the recent pedagogical literature we cannot pursue this subject further, since our aim has been to confine ourselves practically to mathematics as a branch of knowledge. In closing we may call attention to a type of literature which is often helpful to awaken interest where other means fail. I refer to the puzzles and curiosities which are apparently isolated from any important theory. A large collection of these is found, for instance, in the fifth edition (1911) of Ball's *Mathematical Recreations and Essays*.

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### BOOK REVIEWS.

*The Teaching of Mathematics in Secondary Schools.* By ARTHUR SCHULTZE.

The Macmillan Company, New York, 1912. xx+370 pages. \$1.25.

Instead of treating the general problems which face a teacher of mathematics in the high school, the author has chosen to provide a text which covers in detail the teaching of algebra and geometry. This makes the book of particular value to the inexperienced teacher.

With this end in view, the theoretical discussion has been cut down to the mere essentials. The present inefficiency of mathematical teaching, the reasons for retaining mathematics in our high school course, the different methods of teaching with their advantages and difficulties, the logical foundations of algebra and geometry, are rapidly reviewed. Such a brief summary must, of necessity, consist of little more than a statement of facts. An outline of this kind might be rendered more valuable both to old and new teachers by references to more detailed discussion of certain topics. Such references the author has in most cases failed to provide.

For the inexperienced teacher, the first book of plane geometry is full of difficulties. The author has attempted to smooth out some of these by a very detailed treatment. He discusses the characteristics of a good definition, and points out the difficulty in forming a definition. He also gives a number of examples to illustrate the preliminary definitions. The author would not have too great stress laid on the first few propositions. He would rather assume their proof and then impress their value by means of simple exercises.

The author insists that the original exercise is the important part of geometrical teaching, for it is only through it that the student gains power to think, and more than this, the original is more under the control of the teacher than the ordinary proposition. Methods of forming exercises are given and a large number of graded problems on the first propositions in triangles are added.

The discussion of the propositions of the first book centers about the equality of triangles and the properties of parallel lines. The treatment includes not only methods of proof but such incidental matters as converses of propositions, use of symbols and logical arrangement. Throughout the discussion in book one, the author uses the arrangement of propositions of Schultze and Sevenoak's *Geometry*. This renders the work less valuable to those teachers who use a text with radically different arrangement.

For the rest of geometry, the treatment is not so detailed. The general topics of the circle, similar figures, methods of attack for theorems and problems, short cuts for the teacher, are given. There is a chapter on limits which gives some very good suggestions in regard to teaching that subject.

For solid geometry, the treatment is confined to a discussion of the aim of the subject, the use of models, and methods of drawing figures. A chapter on applied problems, in which the author takes conservative ground, completes the treatment of geometry.

There are two points of criticism in regard to the discussion of geometry. Little emphasis has been put on the use of algebra in geometry. In view of the fact that algebra is taught before geometry, a more extended use of algebraic methods would seem wise. Again, the geometry course is necessarily limited in time and if more originals are taught, the text must give way. New teachers hardly know what to omit, and an outline of important propositions, if only for the first book, would be valuable, such, for instance, as is proposed by the National Committee of Fifteen on Geometry Syllabus.

The treatment of algebra is much more limited. After discussing what topics should be taught, the author takes up the methods of presenting the difficult ones, such as negative and irrational numbers. There is also a treatment of the use of graphs in the solution of problems, and a discussion of the use of logarithms. A chapter on the use of trigonometry by high school students completes the book.

ROYAL R. SHUMWAY.

*Higher Algebra for Colleges and Secondary Schools.* By CHARLES DAVISON, Sc.D., Mathematical Master at King Edward's School, Birmingham. Cambridge: at the University Press, 1912. vi+320 pages. \$2.00.

The introduction to this book is in part a review of some of the ground covered in the author's *Algebra for Secondary Schools*. We find here four chapters, treating: the binomial theorem for positive integral index, product and polynomial theorems, partial fractions, and complex quantity.

The first chapter contains chiefly examples and exercises which bring out important properties of the binomial coefficients, such as the following: (1) Show that  $(n+1)_nC_0 - n_nC_1 + (n-1)_nC_2 - \dots (-1)^n {}_nC_n = 0$ ; (2) Show that the integral part of  $(a + \sqrt{a^2 - 1})^n$  is odd if  $n$  be a whole number. Here evidently  $a$  also should be a whole number.

The second and third chapters treat briefly in twelve pages the other subjects mentioned above, and include four lists of exercises. The latter are of a distinctly higher type than those found in American texts on College Algebra, yet are within reach of students above the freshman year. The same is true generally of the large number of interesting and instructive lists of exercises scattered through the text.

The treatment of complex quantity in Chapter IV is geometric, the vector  $OP$  being represented by one of the symbols  $(a, \alpha)$  or  $(\rho, \theta)$ . Addition is based on the parallelogram, which includes the construction for the sum of real numbers.